Interaction of Retronasal and Orthonasal Perception of Unfamiliar Flavors

Lindsay Moeller and Christopher Simons
Department of Food Science and Technology, The Ohio State University, 2015 Fyffe Ct., Columbus, OH 43210

Background

- Olfaction is the only dual sense, meaning that the aroma compounds can be perceived in two different ways: orthonasally and retronasally[1]
- Orthonasal perception (through the nose—smelling) is when the odorant pertains to events in the external world[1]
- Retronasal perception (through the mouth—flavor) is when the odorant pertains objects that are internalized[1]
- Though these signals are processed by the same receptors and by the same section of the brain, they are thought to elicit different perceptions, hedonic responses, and behaviors [2]
- Orthonasal perception is more intense than retronasal[2]

Objective

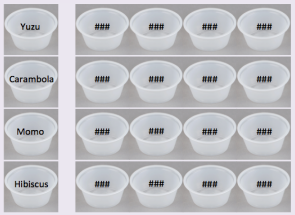
To determine whether routes of aroma delivery impact aroma perception by examining subject's ability to correctly match aromas via orthonasal-orthonasal perception, retronasal-retronasal perception, and retronasal-orthonasal perception.

Materials and Methods

- Sample size = 20 Panelists
- Unfamiliar flavors given retronasally or orthonasally in diluted water solutions: Yuzu, Carambola, Momo, and Hibiscus in clear plastic cups
- Water and crackers given to each panelist in order to cleanse the palette in between samples

Samples are given under three conditions:

Orthonasal known sample to four orthonasal unknown samples
Retronasal known sample to four retronasal unknown samples
Retronasal known sample to four orthonasal unknown samples



- Reference and unknown samples are given in random order
- Unknown samples are labeled with random 3-digit number
- Set of reference and unknown samples are given at the same time for each set of conditions

Results

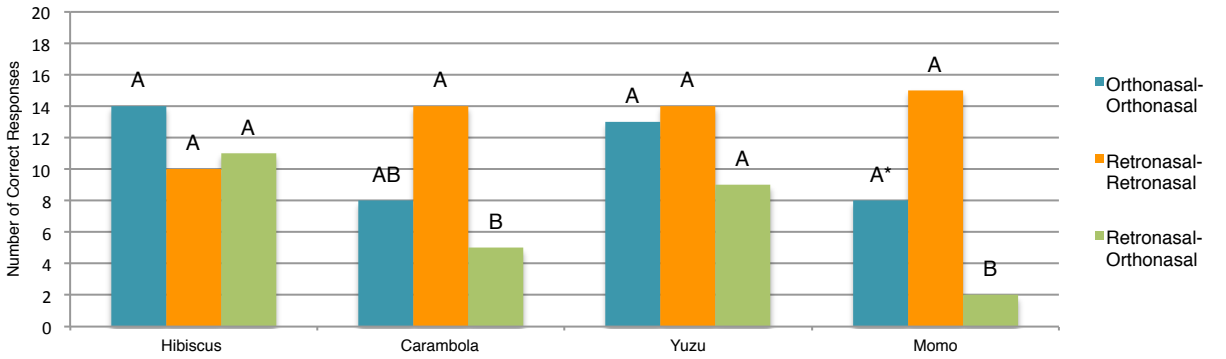


Figure 1: Correct Responses of Panelists Identifying Unknown Flavors under Orthonasal-Orthonasal, Retronasal-Retronasal, and Retronasal-Orthonasal Conditions

[AB]For each flavor grouping, bars having different superscripts are significantly different by McNemar's Test for Correlated Proportions
*The orthonasal-orthonasal versus the retronasal-orthonasal condition produced a p-value of 0.07, meaning the results are close to significantly different and would trend to be significantly different if the sample size were larger

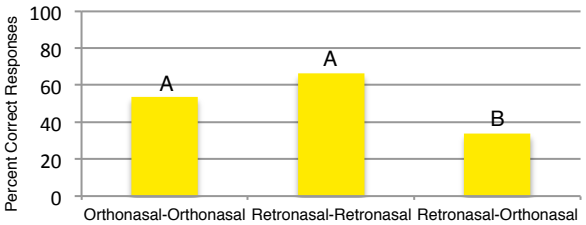
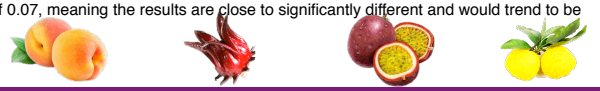


Figure 2: Overall Percentage of Correct Responses under Orthonasal-Orthonasal, Retronasal-Retronasal, and Retronasal-Orthonasal Conditions

[A]The two conditions are not significantly different in the percent of correct results from the panelists (p=0.111)
[B]The retronasal-orthonasal condition was significantly differently than the other two conditions of orthonasal-orthonasal and retronasal-retronasal (p^{OOvRO}=0.012, p^{RRvRO}<0.001)



Discussion and Conclusion

- The retronasal-orthonasal proved to be the most difficult condition for panelists to correctly identify the unknown flavors
- Hibiscus and Yuzu were two flavors showing no significance between the conditions, meaning the orthonasal and the retronasal flavor perception were equally easy to identify particular attributes (Figure 1)
- Panelists may have performed better than expected in the retronasal-retronasal because they were able to use both aroma and gustation to identify attributes of the flavors (Figure 2)
- With more panelists surveyed in the sample, the difference between the results will likely become more significant

Future Research

- Same experiment should be performed with familiar but different flavor samples to compare to the present data.
- Same experiment should be performed with known flavors having similar, but different flavor attributes, (e.g. different types of coffee) to compare to the present data.
- More panelists will be sampled under these conditions in order to create more power for the performed test and determine if there are significant differences

References

[1] Small, DM, Gerber, JC, Mak, YE, Hummel,T. 2005. Differential Neural Responses Evoked by Orthonasal versus Retronasal Odorant Perception in Humans. Neuron. Vol 47. Philadelphia: Elsevier. Pg. 593-605.
[2] Small, DM, Voss, J, Mak, YE, Simmons, KB, Parrish, T, Gitelman, D. 2004. Experience-Dependent Neural integration of Taste and Smell in the Human Brain. J of Neurophysiology. Vol 92. Bethesda: American Physiological Society..Pg. 1892-1903.